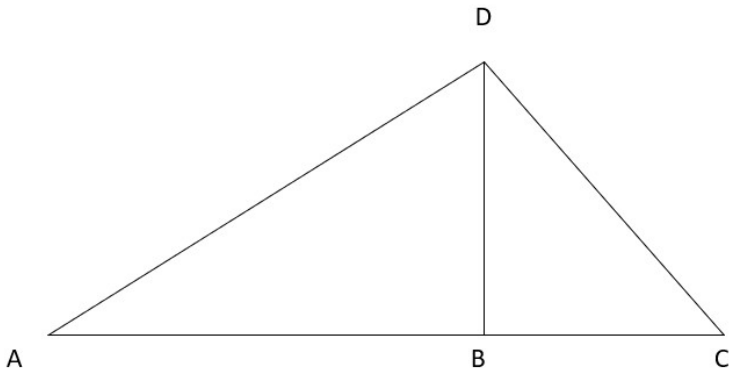
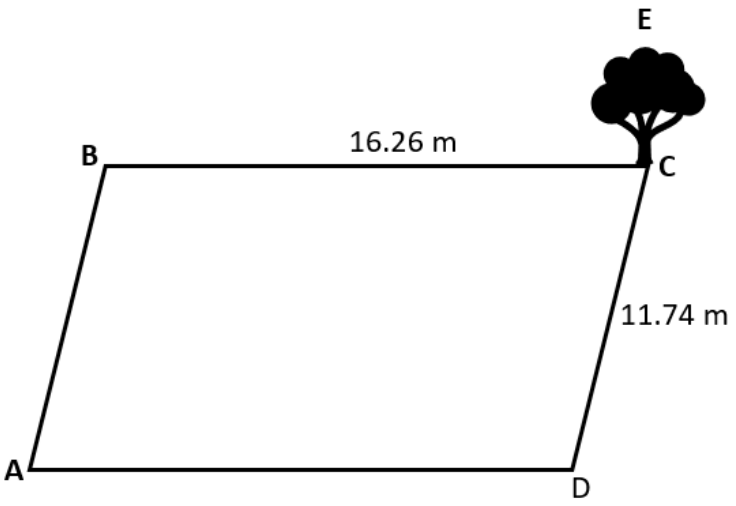
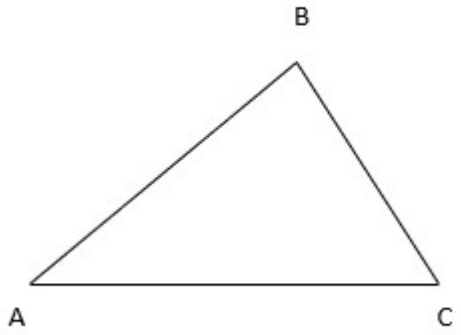
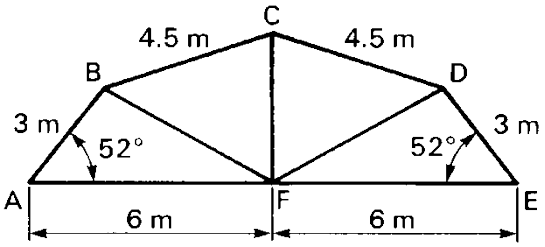
BTEC Assignment Brief Qualification	Pearson BTEC International Level 3 National Diploma in Civil Engineering Pearson BTEC International Level 3 National Extended Diploma in Civil Engineering
Unit number and title	Unit 6: Construction Mathematics
Learning aim(s)	**C:** Examine and apply geometric and trigonometric techniques correctly to solve practical construction problems **D:** Investigate the use of statistical and graphical methods correctly to solve construction problems.
Assignment title	**Trigonometry and Statistics**
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	You have been employed as a trainee engineer in the design office of a large Engineering Design Consultancy practice. You will be working in the quantity surveying section who specialise in measuring and costing various elements of work. This can include area and volume calculations, quantity of materials to be ordered, setting out dimensions and angles may also be needed for contractors. It is vital that you can demonstrate your understanding of the mathematical methods and techniques required for these key activities.
Task 1	A beech tree which is situated on a level site must be retained. A land surveyor within the company has asked you to calculate the height of the tree. You position a theodolite 45m from its base. The observed angle of elevation to the top of the tree is $21^0\,37'\,12''$. Given that the instrument is 1.5m of the ground, calculate the height of the tree. Produce a sketch and state any assumptions you have made.
Task 2	You have been asked by an engineer in the company to help with calculations for a roof. You have been requested to calculate the sizes of the members and angles so that the roof structure can be built. The cross-section through the triangular roof structure is shown below. (giving values to 2 decimal places): i. the height of the roof DB ii. the length of the member AB iii. the angle BCD iv. the length of the rear stay CD The angle DAB is 33 degrees. AD= 9584mm BC=10679mm

Pearson BTEC

	
Task 3	An engineer working on a site has asked for your assistance. A tree is located in the corner of a flat rectangular field. The field is 16.26 metres long by 11.74 metres wide. The tree is 6.4 metres tall. Calculate angle CAE 
Task 4	The roof of an old factory to be renovated comprises a simple triangular structure as shown below. The engineer looking after the work has asked you to complete some calculations. (Note this is not a right angle triangle). The angle at *A is 32*º, the span *AC* is 7 m and *AB* is 4.4 m long. Determine: (i) the length of *BC* (ii) the angles *ABC* and *BCA* (iii) the area enclosed by the roof structure.

Pearson BTEC

	
Task 5	The drawing of a roof has been sent to you. As an assistant to a quantity surveyor you are required to I. Find the lengths of all the members in the roof truss. II. Summarise your results in a table. III. Calculate the volume of the roof space if the roof is 36m long; showing all steps in the calculation (answers to 3 decimal places); and apply appropriate rounding values to the calculation to the final answer ***(Diagram from (page 55) BTEC National NIII Mathematics for Technicians A. Greer and G.W Taylor ISBN 0-85950-932-x)*** 
Task 6	A site engineer working on site uses a 30 m steel tape to set out a new building. The temperature in the country can vary from -10ºC to 40ºC depending on the time of year. It is important that the building is set out to the absolute correct dimensions so therefore the measurements have to be adjusted according to the temperature at the time of year. Assume that steel tapes expand and contract at a rate of 0.014mm/m/°C, and that steel tapes are calibrated to measure

accurately at 20ºC.

Determine, using a graphical method, the reading in metres, which would correspond to

(a) 117 metres at a temperature of 4 ºC
(b) 163 metres at a temperature of 31 ºC

Task 7

Paving slabs are to be used extensively throughout a construction site. A sample of 50 paving slabs was taken from each of two suppliers. The depth of the slabs was measured, and the results recorded to the nearest mm.

(i) Produce a distribution table of the data
(ii) determine the mean, median, mode and range of each sample
(iii) Produce a cumulative frequency diagram
(iv) state with reasons which supplier is most likely to produce slabs closest to the required depth of 6cm.

Supplier A (cm)		Supplier B (cm)	
6.1	6.2	5.9	6.0
6.2	6.3	5.8	5.8
5.9	5.9	6.2	6.3
5.8	5.9	6.3	5.6
6.0	5.7	6.0	6.1
6.1	5.9	6.1	6.1
5.7	6.0	5.7	5.8
5.8	6.0	5.6	6.0
6.0	6.1	5.9	6.0
6.0	5.9	5.6	5.9
5.6	5.8	5.8	6.3
5.2	5.9	6.0	6.2
6.2	6.1	6.0	6.1
6.1	6.1	6.0	5.7
5.9	6.2	5.9	5.7
5.8	5.9	5.4	5.9
5.9	5.8	5.8	6.3
5.8	5.9	6.3	5.6
6.1	6.1	6.2	6.0
6.4	6.0	6.1	6.1
6.3	6.1	6.3	6.0
5.9	6.2	5.9	6.3
5.9	5.6	6.0	5.9
5.8	6.0	5.6	5.9
6.1	6.0	5.7	5.7

Task 8

The following data was recorded during a tensile test on a mild steel test piece of circular cross-section.

Diameter of cross-section = 25 mm gauge length = 250 mm,

Load/extension readings

Load kN	Extension mm
0	0.00
20	0.05
40	0.10
60	0.16
80	0.21
100	0.26
120	0.31
140	0.36
150	0.38
160	0.41
170	0.44
172	0.47
174	0.50
176	0.55
175	0.62
178	0.72
180	0.76
190	0.90
200	1.07
210	1.25
220	1.46
230	1.70
240	1.99
250	2.51
257	3.12
260	3.75
259	5.00
256	5.50
250	5.60
242	5.80
229	5.85

(i) Plot the load/extension graph and from it find:
(ii) The Modules of elasticity of the material (Young's Modules)
(iii) the elastic and plastic region.
(iv) the yield stress
(v) the ultimate or maximum stress.

Task 9

The data presented in the table indicates the results of tensile tests on 100 specimens of steel.

	Calculate (i) the mean, median, mode and range (ii) the standard deviation of the results Compressive strength N/mm^2 / No. of cubes 600-604 / 3 605-609 / 7 610-614 / 18 615-619 / 27 620-624 / 26 625-629 / 13 630-634 / 5 635-639 / 1
Task 10	If the error in measuring the radius of a concrete sphere is 1 %. Apply the binomial theorem to calculate the approximate errors in the outer surface area of the sphere and the volume of the sphere.
Checklist of evidence required	A well-presented report with calculations, drawings, units and alternative mathematical methods to check solutions were appropriate. Clear conclusions should be drawn on the outcomes for the industrial related situations.

Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria you must show that you are able to:
6/CD.D2	Apply the use of binomial theory to small errors problem and demonstrate an understanding of the limitations of certain solution in terms of accuracy, approximations and rounding errors.
6/C.M3	Demonstrate the use of appropriate trigonometric techniques to solve one complex 3D construction industry-related problem.
6/D.M4	Demonstrate the use of standard deviation techniques to compare the

	quality of manufactured products used in the construction industry.
6/C.P5	Demonstrate the use of trigonometric techniques to solve simple 2D construction problems.
6/C.P6	Demonstrate the use of geometric techniques to solve simple construction problems
6/D.P7	Demonstrate the use of statistical techniques to solve practical construction problems.
6/D.P8	Demonstrate the use of graphical techniques to solve practical construction problems

Sources of information to support you with this Assignment	"Construction Maths: Advanced" by Robert Beslen (ISBN 9780340662373)
Other assessment materials attached to this Assignment Brief	